NOTES FROM PACIFIC COAST OBSERVATORIES.

The Results of an Effort to Determine Motion within the Solar Corona.[1]

The existence of material in the corona, at various distances from the Sun, implies that it has come from somewhere, no doubt very largely, or even almost exclusively, from the Sun itself. The changed coronal forms and structures observed at different eclipses are further evidence that motion occurs. Is the material moving out from the Sun, or toward the Sun, or both? Accurate observational knowledge on this subject is very meager.

At the eclipse of 1901, favorable conditions existed in the corona for determining velocities. Measures of short-exposure negatives taken near the beginning and end of totality by the Crocker Expedition to Sumatra showed no displacements of coronal masses in the interval of a little more than five minutes.[2]

Considering the accuracy of measurement, a velocity of twenty miles per second across the line of sight should have been detected with certainty, and motions should have been suspected had they been as great as twelve or fifteen miles per second.

The unusually favorable eclipse of August 30, 1905, afforded a hope that large-scale photographs of the corona secured in Labrador, Spain, and Egypt, or in two of these countries, would enable us to detect changes in the coronal structure occurring in the long intervals between the times of totality in those countries. Such photographs were obtained by the Crocker expeditions to Spain and Egypt, cloudy weather having prevailed in Labrador. The Spanish plates were secured by Messrs. Campbell and Perrine, with the assistance of Dr. R. S. Dugan and Professor Felipe Lavilla; and the

[1] From *Lick Observatory Bulletin*, No. 115.

[2] *Lick Observatory Bulletin*, Vol. I, 152, 1902.

Egyptian plates by Professor HUSSEY, with the assistance of the late Professor ROBERT H. WEST and Mr. H. T. R. DRAY. Totality occurred seventy minutes later in Egypt than in Spain.

We have made careful comparison of the coronal images obtained at the two stations. A number of fairly well-defined nuclei existed both east and west of the Sun. Details of structure within the nuclei appeared to change, but the nuclei as a whole seemed to remain in the same positions. Measures of great accuracy cannot be made, principally because the poorer seeing in Egypt affected the definition; but we are able to say that the masses in question could not have moved so much as one mile per second during the interval of 4,200 seconds. Greater speeds might well have occurred within the principal coronal streamers, or within some of the arched forms which inclose prominences, without our having detected them; for their structure is quite uniform, and well-defined nuclei are absent. Thus, in the structures where higher speeds should perhaps be most naturally expected, photographic methods have little chance to detect them. However, it is not improbable that at some future eclipse well-defined nuclei in coronal streamers will exist and be recorded at two or more stations.

Our result is in harmony with ARRHENIUS's view of coronal origin: "It is very probable that those drops for which gravitation is just compensated by the pressure of radiation will be the chief material of the inner corona. For drops of other sizes are selected out, the heavier ones by falling back to the Sun, the lighter ones by being driven away by the pressure of radiation, so that the drops which, so to say, swim under the equal influence of gravitation and pressure of radiation will accumulate in the corona."[1]

Assuming that motions of appreciable size exist within the corona, it should be said that the spectrographic method of determining them is unpromising, for several reasons. The exposures are from necessity short, and the coronal light is intrinsically weak. The brighter parts of the corona radiate light forming a continuous spectrum, neglecting the almost insignificant component which gives rise to bright lines, and the relatively small quantity of reflected photospheric light.

[1] ARRHENIUS, *Lick Observatory Bulletin*, Vol. II, 190, 1904.

Spectrograms of the middle and outer corona, obtained with a relatively wide slit and low dispersion, record the Fraunhofer lines but faintly. A spectrogram of good strength would probably be difficult and uncertain in interpretation, as the slit of the spectrograph would receive light from streamers which radiate in a variety of directions from the Sun. Recalling that a reflecting particle moving directly from the Sun toward the observer will not displace the spectrum lines at all; that a reflecting particle moving directly away from, or directly toward, both Sun and observer, will give double displacement of the lines toward the red or toward the violet, respectively; and that the coronal light falling upon the slit is from particles possessing a great variety of motions between these limits; the complexity of the result is evident.

All the spectrographic measures of motion within the shallow gaseous stratum giving the bright lines are likewise in accord with ARRHENIUS'S theory.

March, 1907.

W. W. CAMPBELL,
C. D. PERRINE.

NOTE ON A DISTURBED REGION IN THE CORONA OF AUGUST 30, 1905.[1]

The large-scale photographs of the corona of August 30, 1905, secured by the Crocker expeditions to Spain and Egypt, show an extensive region in the southeast quadrant composed of prominent streamers which appear to radiate from a common point. The space-form of this region seems to be approximately conical. The apex of the cone, projected upon the photographic plate, is some distance within the Sun's limb. The apex no doubt is in or near the photosphere, and the apparent axis of the cone is directed radially out from the Sun's edge. This conical volume is similar to but not so prominent as that recorded in the corona of May 18, 1901.

The chromospheric layer in the region crossed by these projected streamers is not very deep, nor does it show special activity. The streamers probably originate far from the limb; but whether on the nearer or further hemisphere of the Sun is uncertain. The estimated points of intersection of the streamers (produced) were marked on the glass side of the Spanish negatives, Nos. 2 and 7, which were exposed at about 8^s and $3^m\ 16^s$, respectively, after the beginning of totality.

[1] From *Lick Observatory Bulletin*, No. 115.